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Worksheet 1. Contact and Methyl Bromide Request Information

The following information will be used to determine the amount of methyl bromide requested and the contact person for this request. It is important that we know whom to contact in case we need additional information during the review of the application.

1. **Location**
(Enter the state, region, or county. Provide more detail about the location if relevant to the feasibility of alternatives to methyl bromide.)

The applicant, International Paper, grows bareroot pine SuperTree seedlings at nine (9) nurseries in the following southeastern states:

Arkansas (1 nursery)	Alabama (2)	Georgia (2)
South Carolina (2)	Texas (2)	

2. **Crop/commodity**
(Include all crops/commodities that benefit from the application of methyl bromide in a fumigation cycle. A fumigation cycle is the period of time between methyl bromide fumigations.)

International Paper is the world's largest seedling grower producing over 350MM bareroot pine SuperTree seedlings in the southeast. To date we have produced nearly 8 billion forest tree seedlings in the U.S. alone, and last year we planted our 6 millionth acre of forestland in the U.S. SuperTree seedling customers consist of private non-industrial land owners, forest industry, and various government agencies. Our customers use SuperTree seedlings for reforestation, wildlife enhancement, and aesthetic and ecosystem regeneration. Greater than 95% of our southeastern nursery production consists of bareroot loblolly (*Pinus taeda*), slash (*Pinus elliotti* i), sand (*Pinus clausa*), and virginia (*Pinus virginiana*) pines.

3. **Climate**
(Individual users should enter their climate zone designation by reviewing the U.S. climate zone map. If a consortium is submitting this application, please indicate the estimated percentage of consortium users in each climate zone. This map is located at the end of this workbook or it can be reviewed online at http://www.usna.usda.gov/ Hardzone/ushzmap.html).

International Paper's SuperTree seedlings represent a diverse array of genetic adaptability and can be planted throughout regions 6, 7, and 8 as defined by the U.S. climate zone map. Bareroot SuperTree seedling nurseries are located in regions 7, and 8.

4. **Soil type** Check the boxes) for the soil types and percent organic matter that apply to your area. If a consortium is submitting this application, please indicate the estimated percentage of consortium users in each soil type.

Soil Type:	**Light**	**X**	**Medium**		**Heavy**		
Organic Matter:	**0 to 2%**	**X**	**2 to 5 %**		**over 5%**		

5. **Other geographic factors that may affect crop/commodity yield (e.g., water table).**
None

6. **Consortium name**	International Paper		**Specialty (check one)**	
7. **Contact name**	Mr. Richard Barham		agronomic	
8. **Address**	P.O. Box 1391		economic	X
	Savannah, Georgia 31402			
9. **Daytime phone**	912-238-7595	**10. FAX**	912-238-6131	
11. **E-mail**	richard.barham@ipaper.com			

Worksheet 1. Contact and Methyl Bromide Request Information

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List an additional contact person if available.

Specialty (check one)

12. Contact name Dr. George Lowerts — agronomic X

13. Address P.O. Box 56 — economic _____

Bellville, Georgia 30414

14. Daytime phone 912-739-4721 **15. FAX** 912-739-9409

16. E-mail george.lowerts@ipaper.com

17. How much active ingredient (ai) of methyl bromide are you requesting for 2005? 92,000 **lbs.**

If a consortium is submitting this application, the data for question 17 and 17a. should be the total for the consortium.

In the question below, area is defined as follows for each user: acres for growers, cubic feet for post harvest operations, and square feet for structural applications.

17a. How much area will this be applied to? Please list units. 270 Acres **units**

18. Are you requesting methyl bromide for additional years beyond 2005? **Yes** X **No** _____

18a. If yes, please list year and quantity active ingredient (ai) of methyl bromide requested in the table below and explain why you need authorization for multiple years.

Requests beyond 2005

A portion of all International Paper SuperTree seedling nurseries are fumigated each year. The request for a Critical Use Exemption is based on this annual application requirement.

2006 92,000 lbs

2007 92,000 lbs

If a consortium is submitting this application, the data below should be the total for the consortium.

In the table below, area is defined as follows for each user: acres for growers, cubic feet for post harvest operations, and square feet for structural applications.

Year	Quantity ai (lb.) of Methyl Bromide	Area to be Treated	Unit of Area Treated
2006	92,000	270	Acres
2007	92,000	270	Acres

19. Target Pest(s) or Pest Problem(s):

(Be as specific as possible about the species or classes of pests relevant to the feasibility of alternatives.)

At all International Paper SuperTree nurseries, methyl bromide fumigation is a cost effective and essential treatment for the production of bareroot pine seedlings. Methyl bromide fumigation is critical for the control of weed (broadleaf and grasses) seed, particularly yellow and purple (*Cyperus spp.*) nutgrass since there is no other control product or economically feasible control method available. Both yellow and purple nutsedge are included in the United Nations list of the world's top ten worst weeds. Without methyl bromide fumigation, nutgrass will rapidly dominate seedling production areas reducing seedling quality to such an extent that the crop may not be suitable for reforestation and ecosystem regeneration. As a quarantine measure, the USDA requires all shipments of seedlings to be free of fire ants (*Solenopsis invicta*). Methyl bromide fumigation is the only practical method for controlling fire ants over large areas. In addition, many soil fungal pathogens (ex. *Macraphomia spp., Cylindrocaldium spp., Fusarium spp., Pythium spp., Rhizoctonia spp.*) are effectively controlled. These root rot pathogens have the ability to literally result in the destruction of pine seedling crops. Seedling quality is also reduced by nematodes which attack pine seedlings. Fumigation with methyl bromide has been demonstrated to effectively control the following genera: Criconemoides, and Helicotylenchus. There is no other product or control method available that will economically and practically control all of the above pathogens and pests as does a single methyl bromide fumigation. After many years of investigating integrated pest management alternatives including solarization, organic amendments, and cultural controls, Weyerhaeuser has concluded no single alternative has the broad spectrum biocidal efficacy of methyl bromide (EPA, 2002). A description of the economic and environmental impact associated with a withdrawal of methyl bromide on International Paper and on southeastern forestry can be found in appendix 4.

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Worksheet 1. Contact and Methyl Bromide Request Information

20. If applying as a consortium for many users of methyl bromide, please define a *representative user*. Define exactly, issues such as size of the operation (acres treated with methyl bromide for growers, cubic feet for post-harvest operations, and square feet for structural applications), whether the representative user owns or rents the land or operation, intensity of methyl bromide use (treat regularly or only when pest reaches a threshold), pest pressure, etc.

Representative User

International Paper has nine (9) SuperTree seedling nurseries in the southeast that range in size from 100 to 200 plantable acres. A typical International Paper nursery has about 140 acres available for growing bareroot seedlings in any given year. Of these 140 acres, only 70 acres are used each year for growing seedlings. Our nurseries operate with a 2:2 crop rotation consisting of two years in seedlings and two years in cover crop with methyl bromide fumigation applied to the soil just before sowing the seedling crop. Of the total amount of land used to grow seedlings every year approximately one-half is fumigated each year, thus, our typical International Paper nursery would fumigate 35 of the 70 acres available for growing seedlings each year. Across all nine SuperTree nurseries, we expect to fumigate approximately 270 acres each year.

20a. Explain why this user represents the typical user in the consortium.

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Worksheet 2-A. Methyl Bromide - Use 1997-2000

If a consortium is submitting this application, all data should reflect the **actual** data for the consortium.

Col A: Formulation of Methyl Bromide	Enter the appropriate data in Col B-M for each formulation, if known, and/or the totals and averages for all formulations. If you enter only the total and averages for all formulations in the last row of the table, please describe in the comments section the formulations typically used, or the approximate proportions of the formulations used.
Col B, E, H, K: Actual Area Treated	Enter the total actual area treated. Note: This number should be the total actual area treated by the individual user or total actual area for the entire consortium, for the year indicated.
Col C, F, I, L: Actual Total lbs. ai of Methyl Bromide Applied	Enter the actual total pounds active ingredient (ai) of methyl bromide applied. Note: This number should be the total pounds ai applied by the individual user or the entire consortium, for the year indicated.
Col D, G, J, M: Actual Average lbs. ai Applied per Area	The average application rates in pounds ai of methyl bromide per area are automatically calculated from the previous 2 columns.

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D	E	F	G	H	I	J	K	L	M
Formulation of Methyl Bromide	**1997**			**1998**			**1999**			**2000**		
	Total Actual Area Treated	**Actual Total lbs. ai of Methyl Bromide Applied**	**Average lbs. ai Applied per Area**	**Total Actual Area Treated**	**Actual Total lbs. ai of Methyl Bromide Applied**	**Average lbs. ai Applied per Area**	**Total Actual Area Treated**	**Actual Total lbs. ai of Methyl Bromide Applied**	**Average lbs. ai Applied per Area**	**Total Actual Area Treated**	**Actual Total lbs. ai of Methyl Bromide Applied**	**Average lbs. ai Applied per Area**
over 95% methyl bromide	334	126,144	378	193	70,170	364	413	151,775	367	143	52,336	366
75% methyl bromide, 25% chloropicrin												
67% methyl bromide, 33% chloropicrin	10	2,350	235	24	5,640	235	39	9,165	235	17	4,053	238
50% methyl bromide, 50% chloropicrin												
90% methyl bromide, 10% chloropicrin							4	1,253	313	136	40,785	313
57% methyl bromide, 43% chloropicrin										2	456	228
All formulations of methyl bromide	344	128,494	374	217	75,810	349	456	162,193	356	298	97,630	328

Comments:

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Worksheet 2-B. Methyl Bromide - Crop/Commodity Yield and Gross Revenue 1997-2000

If a consortium is submitting this application, the data for this table should reflect the **actual averages** for the consortium.

The purpose of this worksheet is to estimate the gross revenue for 1997 - 2000 when using methyl bromide. Post-harvest and structural users may work with EPA to modify this form to accommodate differences in operations when providing gross revenue data.

Col. A: Year 2000	Be sure to enter the year. Use as many rows as needed for each year for all the crops/commodities in the fumigation cycles from 1997 to 2000. If a fumigation cycle overlaps more than one calendar year, then the year of the fumigation cycle is the year methyl bromide was applied.
Col. B: Crop/Commodity **Forest Tree Seedlings** **Pine & Hardwoods**	Enter all crops/commodities that benefit from methyl bromide in each fumigation cycle. (For example, if normally methyl bromide is applied and tomatoes are grown and harvested followed by peppers without an additional treatment of methyl bromide, then both tomatoes and peppers would be part of the same fumigation cycle.) See the Fumigation Cycle Worksheet for a comprehensive definition of the fumigation cycle. If someone other than the applicant benefits from the application of methyl bromide in the fumigation cycle and you do not have the quantitative data for the crops grown on the same land, please indicate so in the comments section below.
Col. C: Unit of Crop/Commodity	Enter the unit of measurement for each crop/commodity.
Col. D: Crop/Commodity Yield	Enter the number of units of crop/commodities produced per area.
Col. E: Price	Enter the average prices received by the users for the year and crop/commodity indicated (1997-2000).
Col. F: Revenue	This number is calculated automatically using the values you entered in Cols. D and E. You may override the formula to enter a different revenue. Please explain why the revenue amount is different in the comment section below.
Total Revenue for 1997-2000	Enter the total revenue per year by adding the revenue for all crops for that year.
Average Revenue per Year:	The average revenue per year is calculated automatically using the summary data you enter for each year.

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D	E	F
Year Methyl Bromide was Applied	**Crop/Commodity**	**Unit of Crop/Commodity** (e.g., pounds, bushels)	**Crop/Commodity Yield** (Units per area) acres	**Price** (per unit of crop/commodity) thousand seedling	**Revenue** (per area) acres
1997	1st year after fumigation seedlings	per thousand trees	658	$34	$22,372
1998	1st year after fumigation seedlings	per thousand trees	658	$36	$23,688
1999	1st year after fumigation seedlings	per thousand trees	658	$37	$24,017
2000	1st year after fumigation seedlings	per thousand trees	658	$39	$25,662
				Total Revenue for 1997	$22,372
				Total Revenue for 1998	$23,688
				Total Revenue for 1999	$24,017
				Total Revenue for 2000	$25,662
				Average Revenue Per Year	$23,935

Comments: **Crop/Commodity Yield and Gross Revenue 1997-2000**

Revenue is only generated in years that seedlings are grown. In a 2:2 rotation, the first two years are in seedlings and generate revenue. The last two years of the four year cycle are in cover crop which does not generate revenue.

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Worksheet 2-C. Methyl Bromide - Crop/Commodity Yield and Gross Revenue 2001

If a consortium is submitting this application, the data for this table should reflect the **representative user** for the consortium.

The purpose of this worksheet is to estimate the gross revenue for 2001when using methyl bromide. Post-harvest users may modify this form to accommodate differences when providing gross revenue data. If 2001 was not a typical year for the individual or for the representative user of a consortium, the applicant may provide additional data for a different year. However, all applicants must complete this worksheet for the year 2001 regardless. Please explain in the comment section at the bottom of the worksheet why 2001 is not considered a typical year, if that is the case.

Col. A: Crop/Commodity	Enter all crops/commodities that benefit from methyl bromide in the fumigation cycle (interval between fumigations) beginning with the treatment of methyl bromide in 2001. If multiple crops are grown during the interval between fumigations (e.g. tomatoes followed by peppers in a single growing season, or strawberries followed by lettuce over 2 or 3 years) include all of the crops during the entire interval. See the Fumigation Cycle Worksheet for a comprehensive definition of the fumigation cycle. If someone other than the applicant benefits from the application of methyl bromide in the fumigation cycle and you do not have the quantitative data for the crops grown on the same land, please indicate so in the comments section below.
Col. B: Price Factors	Enter factors that determine prices (e.g., grade, time, market). If you received different prices for your crop/commodity as a result of quality, grade, market (e.g. fresh or processing), timing of harvest, etc., you may itemize by using more than one row. Itemize or aggregate these factors to the extent appropriate in making the case that the use of methyl bromide affects these price factors.
Col. C: Unit of Crop/Commodity	Enter the unit of measurement for each crop/commodity.
Col. D: Crop/Commodity Yield	Enter the number of units of crop/commodity produced per area for that price factor.
Col. E: Price	Enter average 2001 prices received by the users for that crop/commodity and price factor.
Col. F: Revenue	Revenue is automatically calculated using the data you entered for yield and price. If revenue is not equal to yield times price, you may override the formula and enter a different revenue amount. Please explain why this revenue amount is different in the comment section below.

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D	E	F
Crop/Commodity	**Price Factors** (grade, time, market)	**Unit of Crop/Commodity** (e.g., pounds, bushels)	**Crop/Commodity Yield** (Units per area) acre	**Price** (per unit of crop/commodity) thousand seedlings	**Revenue** (per area) acres
Bareroot Seedlings Pine	seedling quality, genetic gain, market	per thousand trees	675	$ 40.00	$ 27,000.00
	fluctuations				
				Total Revenue	$ 27,000.00

Comments: Note: revenue is only generated during the first two years following fumigation when the land is growing bareroot seedlings.

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Worksheet 2-D. Methyl Bromide - Use and Costs for 2001

If a consortium is submitting this application, the data in Cols. B, C, D, and E should reflect the *representative user* in the consortium. The data in Col. F should reflect the **actual** area treated by all users in the consortium.

If the methyl bromide is custom applied then put the cost per area in Column G and fill in the average lb ai of methyl bromide applied per area (Col B) and the Total Actual Area Treated (Col F).

If 2001 was not a typical year for the individual or for the representative user of a consortium, the applicant may provide additional data for a different year. However, all applicants must complete this worksheet for the year 2001 regardless. If you provide an additional year's data, please explain in the comment section at the bottom of the worksheet why 2001 is not considered a typical year.

Col. A: Formulation of Methyl Bromide	Enter the appropriate data in Col B-G for each formulation, if known, and/or the totals and averages for all formulations of methyl bromide. If you just enter data in the bottom row in the table (All formulations of methyl bromide), please describe in the comments, the relative usage of the various formulations, to the extent known.
Col B: Average lbs. active ingredient (ai) of Methyl Bromide Applied per Area	Enter the average pounds active ingredient (ai) of methyl bromide applied per area.
Cols. C, D, E, G: Prices and Costs	Enter the average price per pound active ingredient (ai) of methyl bromide in Col. C and the average cost of applying methyl bromide per area treated in Col. D. In Col. E, enter the average other costs per area associated with applying methyl bromide (e.g., tarps). Column G will be calculated automatically using the values you entered in columns B-E. If methyl bromide is custom applied, enter the cost per area in Col. G and fill in Cols. B and F.
Col. F: Actual Area Treated	Enter the **actual** area treated. Note: This number should be the total area treated by all users in the consortium.

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D	E	F	G
Formulation of Methyl Bromide	**Lb. ai of Methyl Bromide Applied per Area (2001 Average)**	**Price per lb. ai of Methyl Bromide (2001 Average)**	**Cost of Applying Pesticide per Area (2001 Average)**	**Other MBr Costs (e.g. tarps, etc.) per Area (2001 Average)**	**Total Actual Area Treated in the Consortium (acres)**	**Cost per Area**
over 95% methyl bromide						
75% methyl bromide, 25% chloropicrin						
67% methyl bromide, 33% chloropicrin						
50% methyl bromide, 50% chloropicrin						
90% methyl bromide, 10% chloropicrin						
_80_% methyl bromide, 20__% chloropicrin	280	$2.70	$300		270	$ 1,795.00
All formulations of methyl bromide	280	$2.70	$300		270	$ 1,795.00

Comments:

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Worksheet 2-E. Methyl Bromide - *Other* Operating Costs for 2001

Do not include methyl bromide costs.

If a consortium is submitting this application, the data for this table should reflect a **representative user**.

Enter all operating costs except methyl bromide costs incurred during the fumigation cycle (interval between fumigations) beginning in 2001. See the Fumigation Cycle Worksheet for a comprehensive definition of the fumigation cycle. Enter these costs in Col B for custom operations, **or** in Col C and D for operations done by user.

Submit crop budgets for each crop, if available. You may submit crop budgets electronically or in hard copy. If your costs are significantly different than the crop budgets, please explain in the comments.

Col A: Operation	Identify in Col A the operations (except methyl bromide) to which the costs apply. For growers, these operations should include but are not limited to (1) prepare soil, (2) fertilize, (3) irrigate, (4) plant, (5) harvest, (6) other pest controls, etc. You must include all other operating costs.
Col B: Custom Operation Cost	If you incur custom operation costs, enter those costs in Col. B.
Col C: Material Cost per Area	If you do not incur custom operation costs, enter the material cost per area.
Col D: Labor Cost per Area	If you do not incur custom operation costs, enter the labor cost per area.
Col E: Total Cost per Area	The total cost per area is calculated automatically from the values you enter in Cols. C and D.
Col F: Typical Equipment Used	Identify the typical equipment used for operations done by user. Please be specific, such as tractor horsepower. No cost data is required in this column.

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D	E	F
Operation	**Custom Operation Cost per Area**	**Operation Done by User**			
		Material Cost per Area	**Labor Cost per Area**	**Total Cost per Area**	**Typical Equipment Used**
Soil Preparation for Sowing Seeds		$ 592.42	$ 573.48	$ 1,165.90	
Sowing Pine Seeds		$4,457.98	$ 549.68	$ 5,007.66	
Crop Cultural Activities		$1,061.36	$1,412.02	$ 2,473.38	
Lifting, packing, shipping crop to		$3,682.85	$ 897.27	$ 4,580.12	
customers					
Total Custom per Area			**User Total per area**	$ 13,227.06	

Note: The operations listed are typical for each International Paper SuperTree seedling nursery

Operations Details:

Soil Preparation:	Typical farm tractor and implements
Sowing:	Highly specialized machine sowers are used to sow genetically improved seed. Power supplied by farm tractor.
Maintenance	Standard tractor drawn boom sprayers. Implements for fertilization, top and root pruning are specially designed for forest tree nurseries.
Harvest	Highly mechanized harvesting operation using specially designed seedling lifters. Seedlings placed in cold storage until shipped

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Worksheet 2-F. Methyl Bromide Fixed and Overhead Costs in 2001

If a consortium is submitting this application, the data for this table should reflect a **representative user.**

Enter **all** fixed and overhead costs incurred during the fumigation cycle (interval between fumigations) beginning in 2001. See the Fumigation Cycle Worksheet for a comprehensive definition of the fumigation cycle.

Col A: Cost Item	Identify in Col. A the cost items. These items should include, but are not limited to: (1) land rent, (2) interest, (3) depreciation, (4) management, and (5) overhead such as office and administration.)
Col B: Description	Please describe the cost in more detail.
Col C: Allocation Method	Please describe how you estimated the portion of total fixed cost of the farm or entity that applies to this crop/commodity.
Col D: Cost per Area	Enter the cost per area of methyl bromide treated.

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D
Cost Item	**Description**	**Allocation Method**	**Cost per Area**
Labor and Labor Related	Managerial and Administrative salaries and benefits		$2,442.99
Travel	Travel Expenses, Business Meals, Conferences		$199.49
Advertising			$92.56
Postage	FedEx, UPS, and regular mail charges		$65.10
Communications	Telephones, Cellular Phones		$201.30
Data Processing			$44.12
Computer Hardware	Computers, printers, etc.		$31.16
Rentals-Tangible Properties	Machine Rentals		$49.06
Rentals-Real Property	Office Rental		$177.94
Vehicle Lease Expenses	Auto Lease and Heavy Equipment		$870.48
Dues and Assessments	Trade Association Dues and Contributions		$14.08
Publications	Trade Magazine Subscriptions		$1.97
Meetings			$22.93
Taxes	Sales and Property Taxes		$398.37
Depreciation	Capitalized Interest and Plant Depreciation		$1,759.79
Gain/Loss on Sale of Assets	Usually a one time loss or gain		-$435.21
Legal Settlements	Company Legal Bill		$207.96
Rental Income	From home on nursery site		-$62.69
Supplies and Equipment	Managerial and Administrative Supplies		$517.87
Other Income/Expenses			$148.05
Utilities	Water and Electricity		$553.89
Allocations and Transfers	Corporate and Division Overhead		$282.35
		Total	$7,583.56

Comments: Data represent costs from a typical International Paper SuperTree seedling nursery growing bareroot pines.

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Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

In this worksheet, you should address why an alternative pest management strategy on the list (see previous
For worksheet 3-A you must complete one worksheet for each alternative, for each research study addressed.
When completing Section II, if you cite a study that is on the EPA website, you only need to complete questions
Summarize each of the research studies you cite in the Research Summary Worksheet.
If you prefer, you may provide the information requested in this worksheet in a narrative review of one or more

BACKGROUND

EPA must consider whether alternative pest control measures (pesticide and non-pesticidal, and their combination) could
There are three major ways you can provide the Agency with proof of your investigative work.
Whether you conduct the research yourself or cite studies developed by others, it is important that the studies be
The Agency has posted many research studies on a variety of crops on its website and knows of more studies currently
In addition, EPA acknowledges that, for certain circumstances, some alternatives are not technically feasible and

Use additional pages as needed.

Alternative: Basamid **Study:** Various see Appendix 3

Section I. Initial Screening on Technical Feasibility of Alternatives

1. Are there any location-specific restrictions that inhibit the use of this alternative on your site?

1a. Full use permitted Yes
1b. Township caps
1c. Alternative not acceptable in consuming country
1d. Other (Please describe)

If use of this alternative is precluded by regulatory restriction for all users covered by this

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Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

Section II. Existing Research Studies on Alternatives to Methyl Bromide

1. Is the study on EPA's website? Yes _____ **No** X

1a. If not on the EPA website, please attach a copy.

See Appendix 3 for list. All articles are part of the public domain and can be used freely.

2. Author(s) or researcher(s) See Appendix 3 for list. Primary investigating agency is the staff of the Auburn University Nursery Cooperative, Drs. Ken McNabb and Bill Carey

3. Publication and Date of Publicatior See Appendix 3

4. Location of research stud Various forest tree seedling nurseries in the southeastern US

5. Name of alternative(s) in study. If more than one alternative, list the ones you wish to discuss.

Basamid

6. Was crop yield measured in the stu Yes x **No** _____

(seedling size, bed density)

7. Describe the effectiveness of the alternative in controlling pests in the study.

Nutsedge (*Cyperus spp.*) populations are not controlled to any great extent by Basamid as indicated in many research studies (Carey, 1994b, 1996; Conn, 2002; Dwinell and Fraedrich, 1997). Also, a 1997 survey of southern forest nursery managers indicated that Basamid was less effective in weed control than methyl bromide (Cram, 1996). The population of nutsedge plants on a nursery bed can quickly expand to epidemic proportions literally covering the developing pine and seedlings (Figure 1,

Appendix 2). As can be expected, the size of the pine seedlings will be dramatically reduced from grade one seedlings to grade 2 or cull seedlings (i.e. unusable) when in competition with nutsedge. South, et al. (2001) demonstrated that a reduction in seedling size by 2mm can result in a net present value loss of $0.10 per seedling. With an annual crop exceeding 350MM seedlings, International Paper can expect to incur an annual loss $35MM just from increased weed competition primarily from nutsedge. Unfortunately, no herbicides are available that will control nutsedge without damaging the nurseries will have to resort to handweeding which increases cost (approximately $662/acre; see section 3-D Basamid).

Seedling size is an important indicator of seedling quality since size at time of field planting is directly related to survival and future tree growth (South, et al, 2001). Basamid has not demonstrated consistent seedling size effects at many study locations and in operational use (Auburn Nursery Cooperative, 2002). Some studies indicate soil treated with Basamid can produce seedlings that have the same average root collar diameter as those seedlings grown in soil treated with methyl bromide fumigation (Carey, 1996). However, several studies clearly demonstrate that Basamid treated soil produces smaller seedlings than soil treated with methyl bromide (Carey, 1994b, 1995, Cary and McNabb, 1996; Dwinell and Fraedrich, 1997). Weed pressure was not a factor in these studies and did not contribute to the reduction in seedling size (Auburn Nursery Cooperative, 2002). Further, Basamid has consistently produced 2.2 fewer seedlings per sq.ft. of nursery bed compared to methyl bromide Paper, a reduction in bed density by just 2 plantable seedlings/sq ft would result in a per acre nursery bed loss of $2.2M.

Many different soil fungi are beneficial to pine seedling growth. Low populations of these fungi will result in erratic seedling growth patterns in the nursery bed and a reduction in seedling size. Basamid treatment has been demonstrated to prolong the recovery of *Trichoderma* (one of the most beneficial fungi) compared to methyl bromide fumigation (South, et.al. 1997; Lyer and White, 1969). The long term effect of repeated use of Basamid on the soil population of *Trichoderma* is unknown. However, Auburn Nursery Cooperative (2002) is very concerned that the populations of beneficial soil fungi may be comprised with Basamid use.

Outgassing is a potentially serious problem with Basamid. At least one case of outgassing from Basamid treated fields has been reported (Auburn Nursery Cooperative, 2002). Methyl-isothiciocyanate (MITC) gas is the active ingredient in Basamid. This gas is released upon the exposure of Basamid to water. Seedling damage from outgassing of fumigation alternatives has also been documented by the J. Herbert Stone Nursery (Scholtes, 1989) Outgassing poses a risk to the health of adjacent seedlings (see Figure 2; Appendix 3) as well as those individuals in residences

8. **Discuss how the results of the study apply to your situation. Would you expect similar results?**
   Basamid studies have been conducted at nurseries similar to those of International Paper and on similar nursery soils. We do not expect results different from those observed in the various research studies. At best, Basamid effects are inconsistent. The lack of nutsedge control is a serious threat to the efficient and economical production of quality pine seedlings.

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Worksheet 3-B. Alternatives - Pest Control Reg

Basamid

If a consortium is submitting this application, the data for this table should reflect a **representative user.**	
Col. A: Name	Enter all alternatives and non-chemical pest control that would replace one treatment of methyl bromide throughout the fumigation cycle. If someone other than the applicant previously benefited from the application of methyl bromide in the fumigation cycle and you do not
Col. B: Target Pests	Be as specific as possible regarding the species or classes of pests controlled by the active ingredient or pesticide product.
Col. C: Active Ingredi	Use one row for each active ingredient (ai). For example, if a product contains 2 ai's use 2 rows for that product. Once a row is completed for a given product, then only Col. B (if applicable), C, and E need to be completed for additional rows regarding the same product.
Col. D: Formulation	Enter the formulation or the % of active ingredient.
Col. E, F, G: Applica	As a cross check, EPA is requesting both the amount of active ingredient in Col. E and product applied per area in Col. F. Indicate the unit of the product in Col. G.
Col. H, I, J: Prices and Costs	**Use 2001 prices and costs.** If the product is custom applied you may enter the total cost in the last column (Col. M) and override the formula. If a pesticide is applied by the user, enter the price of the product in Col. H and the cost of applying it in Col. I. Enter any other costs associated with **applying** this product in Col. J, specifying what they are in the comments section at the bottom of this sheet.
Col. K: Area Treated	Enter the area receiving at least one application of the pesticide.
Col. L: # of Applica	Enter the number of applications in a fumigation cycle comparable to methyl bromide for this alternative pest control regimen. Since this number is an average, it does not need to be a whole number.
Col. M: Cost per	Enter the cost per area in 2001 dollars. Col. M will be calculated automatically using the data you have entered for a chemical pest control, or, the formula in Col. M can be overridden if the cost per area is known because the product was custom applied.
Non-chemical Control	Enter data near the bottom of the form. Identify the control in Col. A. Enter the target pests in Col. B. Describe the non-chemical pest control Col. B-L. Enter the costs in Col. M in 2001 dollars.

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D	E	F	G	H	I	J	K	L	M
Name of Product	**Target Pests**	**Active Ingredients (ai) in Product**	**Formulation of Product**	**Application Rate**			**Price per Unit of the Product**	**Cost of Applying Pesticide per Area**	**Other Costs per Application**	**Area Treated at Least Once**	**# of Applications per Year**	**Cost per Area (2001$)**
				lbs. ai per Area per Application	**Units of product per Area per Application**	**Product Unit (e.g., lbs., gals)**						
Basamid	Weeds	MITC	98%	343 acre	350 lbs/a	lbs	#########					$ 2,000.00
	Soil Fungi											$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
mical Pes	**arget Pest**	**Description**										**Cost/area**
											Total	$ 2,000.00

Comments:

If you do not have the quantitative data for additional crops grown on the same land, please indicate so in the comment section.

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Worksheet 3-C. Alternatives - Crop/Commodity Yield and Gross Revenue for Alternati

Basamid

If a consortium is submitting this application, the data for this table should reflect a *representative* user.

The purpose of this worksheet is to identify the gross revenue for units (crop, commodity, structure) when using an alternative compared to gross revenue when using methyl bromide. Post-harvest and structural users may modify this form to accommodate differences in operations when providing gross revenue data.

Col. A: Crop/Commodity	Enter all crops/commodities that can be grown/treated during the same interval of time comprising a methyl bromide fumigation cycle. Please discuss changes in crop cycles resulting from alternative use in the comments. See the Fumigation Cycle Worksheet for a comprehensive definition of the fumigation cycle. If someone other than the applicant benefits from the application of methyl bromide in the fumigation cycle and you do not have the quantitative data for the crops grown on the same land, please indicate so in the comments section below.
Col. B: Price Factors	Enter in Col. B any factors that determine prices (e.g., grade, time, market). If you received different prices for your crop/commodity as a result of quality, grade, market (e.g., fresh or processing), timing of harvest, etc., you may itemize by using more than one row. Itemize or aggregate these factors to the extent appropriate in making the case that the use of alternatives affects these price factors.
Col. C: Unit of Crop/Commodity	Enter the unit of measurement for your crop/commodity.
Col. D: Crop/Commodity Yield	Enter the number of units of crop/commodity produced per area for that price factor identified.
Col. E: Price	Enter the average 2001 prices received by the users for that crop/commodity and price factor.
Col. F: Gross Revenue	In the electronic version, revenue is automatically calculated below using the data you entered for yield and price. If revenue is not equal to yield times price, you may override the formula and enter a different revenue amount. Please explain why this revenue amount is different in the comment

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D	E	F
Crop/Commodity	**Price Factors** (grade, time, market)	**Unit of Crop/Commodity** (e.g., pounds, bushels)	**Crop/Commodity Yield** (Units per area) thousand/acre	**Price** (per unit of crop/commodity) per thousand	**Revenue** (per area) acre
Pine seedlings	seedling quality, genetic gain, market	1000 trees	621	$40	$24,840
	fluctuations				
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
				Total Revenue	$ 24,840.00

Gross Revenue of Alternatives

Comments: Note: revenue is only generated during the first two years following fumigation when the land is growing bareroot seedlings.

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Worksheet 3-D. Alternatives - Changes in Other Costs for Alternative: Basamid

If a consortium is submitting this application, the data for this table should reflect a *representative user* .

Enter data only for costs (other than the cost of alternative pest control) that change as a result of using the alternatives instead of methyl bromide. Enter the whole cost, not just the incremental changes. Enter the cost in Col. B for custom operation costs, **or** in Col. C and D for operations done by user.

Col. A: Operation or Cost Item	Identify the operations or cost items that change as a result of not using methyl bromide.
Col. B: Custom Operation Cost	Enter custom operation costs that change in Col. B.
Col. C, D, E: Costs per Area	Enter in Col. C and D, material and labor costs per area that change for operations done by user. The total cost per area is calculated automatically from the values you enter in Cols. C and D.
Col. F: Typical Equipment Used	Identify changes in the typical equipment used by the user as a result of not using methyl bromide. Please be specific such as tractor horsepower. No cost data are required in this column.

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D	E	F
Operation or Cost Item	**Custom Operation Cost per Area**	**Operation Done by User**			**Typical Equipment Used**
		Material Cost per Area	**Labor Cost per Area (acre)**	**Total Cost per Area (acre)**	
Hand Weeding		0	$60/acre/application	$ 360.00	Hand labor
Increased Herbicide Use					
cover crop / fallow		$24.50	$59.40	$ 83.90	Tractor / Spray Rig
seedling crop		$98.50	$120.00	$ 218.50	Tractor / Spray Rig
Total Custom per Area			**User Total per area**	$ 662.40	

Comments:

Assumes increase in weed populations (ex. Nutsedge) will require one hand weedings per acre per month from May through October. Cost per acre is estimated to be $60 which represents a hand weeding crew of 5 plus one supervisor.

Additional herbicide use will be needed when growing seedlings the first two years of the fumigation cycle and also during the second two years when the soil is fallow or in cover crop.

Additional indirect costs per acre at listed in 3-A

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

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ID#

Research Summary Table

Alternative: Basamid **Study:** See "comments" below

Provide one summary table for each study being described.

Provide a summary table of research information that will allow us compare the impact of methyl bromide and the alternative regimen on such things as pest control, yield or quality of the commodity being treated, or protected. Ideally, a research study should directly compare methyl bromide and the alternative regimen.

Col. A: Treatment Number	List the treatment number from the research study you are citing.
Col. B: Treatment	List what type of pest control method was used.
Col. C: Rate	Enter the pounds or gallons of a chemical used, days of solarization, etc.
Col. D, F, H, J, L, N: Interval	Enter the interval after treatment that the rating was taken. Enter the interval (days, weeks or months) in the column heading or in the comments section. In the comments describe the rating scale (e.g. 0 to 100 where 100 is complete control).
Cols. E, G, I, K, M, O: Rating for Interval:	Use these columns to describe the level of control provided for a specific pest and the time interval at which the rating was taken. For example, a study for nematode control may have looked at nematode population in the soil pre-treatment, 3 weeks after treatment, and 6 weeks after treatment. In this example, type over the words "Rating Interval 1" with "pre-treatment", type over "Rating Interval 2" with "3 weeks", and type over "Rating Interval 3" with "6 weeks." If you are completing the printed version, please define Rating Interval in the comments below.
Control of Pests 1 and 2 (Cols. D - I and Cols. J - O):	For the target pest(s) in the study list the pest or pest species being rated in the column header or the comments section. For example, a study for nematode control in tomatoes may have looked at sting nematode and stunt nematode. Enter sting nematode for pest 1 in the Col F header below and stunt nematode for pest 2 in the Col. L header below. In the comments section describe the rating system used (0 to 100 scale where 0 is no control, number of nematodes per gram of soil, number of colony forming units per gram of soil, etc.)
Col. J: Yield	Enter the marketable yield of the crop or commodity and specify the units (lbs./acre, tons) in the column header or comments section.

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Treatment Number	**Treatment**	**Rate (lbs. or gals. ai per area)**	**Pest 1**						**Pest 2**						**Yield (units/area)**
			Interval 1	**Rating for Interval 1**	**Interval 2**	**Rating for Interval 2**	**Interval 3**	**Rating for Interval 3**	**Interval 1**	**Rating for Interval 1**	**Interval 2**	**Rating for Interval 2**	**Interval 3**	**Rating for Interval 3**	
See Comment															

Comments:

See appendix 3 for list of research publications.

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Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

In this worksheet, you should address why an alternative pest management strategy on the list (see previous
For worksheet 3-A you must complete one worksheet for each alternative, for each research study addressed.
When completing Section II, if you cite a study that is on the EPA website, you only need to complete questions
Summarize each of the research studies you cite in the Research Summary Worksheet.
If you prefer, you may provide the information requested in this worksheet in a narrative review of one or more

BACKGROUND

EPA must consider whether alternative pest control measures (pesticide and non-pesticidal, and their combination) could
There are three major ways you can provide the Agency with proof of your investigative work.
Whether you conduct the research yourself or cite studies developed by others, it is important that the studies be
The Agency has posted many research studies on a variety of crops on its website and knows of more studies currently
In addition, EPA acknowledges that, for certain circumstances, some alternatives are not technically feasible and

Use additional pages as needed.

Alternative: **Metham-sodium** **Study:** **Various see Appendix 3**

Section I. Initial Screening on Technical Feasibility of Alternatives

1. Are there any location-specific restrictions that inhibit the use of this alternative on your site?

1a. Full use permitted Yes
1b. Township caps
1c. Alternative not acceptable in consuming country
1d. Other (Please describe)

If use of this alternative is precluded by regulatory restriction for all users covered by this

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Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

Section II. Existing Research Studies on Alternatives to Methyl Bromide

1. Is the study on EPA's website? **Yes** _____ **No** X

1a. If not on the EPA website, please attach a copy.

See Appendix 3 for list. All articles are part of the public domain and can be used freely.

2. Author(s) or researcher(s) See Appendix 3 for list. Primary investigating agency is the staff of the Auburn University Nursery Cooperative, Drs. Ken McNabb and Bill Carey

3. Publication and Date of Publicatior See Appendix 3

4. Location of research stud Various forest tree seedling nurseries in the southeastern United States

5. Name of alternative(s) in study. If more than one alternative, list the ones you wish to discuss.

Metham-sodium

6. Was crop yield measured in the stu **Yes** x **No** _____
(seedling size, bed density)

7. Describe the effectiveness of the alternative in controlling pests in the study.

Metham-sodium cannot be safely used at International Paper SuperTree seedling nurseries. In 2000, International Paper's Texas nursery at Bullard installed an operational pilot study to evaluate metham-sodium effectiveness on a large scale. The Metham-sodium was applied to the soil during the day. That evening the chemical outgassed from the soil and drifted on the wind. As can be seen in Figure 2 (Appendix 2), the outgassed Metham-sodium killed over 20 million pine seedlings. An even more distressing event occurred with

this outgassing. The Metham-sodium drifted to the property of several people living adjacent to the nursery. Since this event, these individuals have alleged to have health problems related to the outgassing and they are now in litigation with the contract applicator. Outgassing of Metham-sodium from forest tree nurseries has been reported in Louisiana, Mississippi, Arkansas, Oregon, and Montana (Carey, 00). Because of the risk of outgassing and the threat to health of those living downwind, Metham-sodium is not a suitable alternative to methyl bromide fumigation.

Nutsedge (*Cyperus spp.*) populations are not controlled to any great extent by Metham-sodium (when used as a stand alone treatment) as indicated in several research studies (Carey 1996, Fraedrich and Dwinell, 1997). The population of nutsedge plants on a nursery bed can quickly expand to epidemic proportions literally covering the developing pine seedlings (Figure 1, Appendix 2). As can be expected, the size of the pine seedlings will be dramatically reduced from grade one seedlings to grade 2 seedlings when in competition with nutsedge. South, et al, (2001) demonstrated that a reduction in seedling size by 2mm can result in a net present value loss of $0.10 per seedling. With an annual crop exceeding 350MM seedlings, International Paper can expect to incur an annual loss of $35MM just from increased weed competition primarily from nutsedge. Unfortunately, no herbicides are available that will control nutsedge without damaging the pine seedlings. Thus, International Paper SuperTree nurseries will have to resort to handweeding which increases seedling cost.

Some early studies (Carey, 1994a, 1996, 1999, 2000a,b,c, Cram, 1996) with Metham-sodium showed promising results when Metham-sodium was combined with chloropicrin or the herbicide EPTC. Weed control and seedling size were similar to the results obtained with methyl bromide fumigation (Carey, 2000d). Metham-sodium/chloropicrin fumigated soil tends to produce seedlings with less biomass than methyl bromide fumigation (Carey, et al., 2001). Like Basamid, a reduction in the number of seedlings in the nursery bed sometimes occurs. Fewer seedlings available in the nursery translates to less potential revenue.

Metham-sodium application to the soil requires additional soil cultural treatments compared to methyl bromide. A tractor mounted rototiller is needed to incorporate the Metham-sodium into the soil. Each time any vehicle travels over the soil a serious soil compaction risk occurs. A "plow pan" or compaction layer will form in the soil just below the level of the rototiller. This compacted layer retards water infiltration through the soil, reduces aeration, and forms a barrier to root growth. As a consequence, seedling quality can be reduced due to excessive soil moisture and poor pine seedling growth. The Auburn University Nursery Cooperative (2002) has documented nursery soil damage from Metham-sodium application. Application time for Metham-sodium fumigation is two to three times as long as methyl bromide (Parker, 2002). International Paper SuperTree nurseries have a short period when environmental conditions are favorable for fumigation. It is doubtful, that Metham-sodium applications can be completed before adverse soil temperature conditions occur.

8. **Discuss how the results of the study apply to your situation. Would you expect similar results?**
   Metham-sodium has been applied directly to some of our nurseries. The outgassing associated with Metham-sodium cannot be practically avoided. Due to this experience and the outgassing seen at other forest tree nurseries, International Paper cannot safely use Metham-sodium as an alternative to methyl bromide fumigation.

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Worksheet 3-B. Alternatives - Pest Control Regimen Costs for Alternative: Metham-sodium

If a consortium is submitting this application, the data for this table should reflect a **representative user.**

Col. A: Name of Product and Non-chemical Control	Enter all alternatives and non-chemical pest control that would replace one treatment of methyl bromide throughout the fumigation cycle. See the Fumigation Cycle Worksheet for a comprehensive definition of the fumigation cycle. If multiple crops are grown If someone other than the applicant previously benefited from the application of methyl bromide in the fumigation cycle and you do not have the quantitative data for the crops grown on the same land, please indicate so in the comments section below.
Col. B: Target Pests	Be as specific as possible regarding the species or classes of pests controlled by the active ingredient or pesticide product.
Col. C: Active Ingredients	Use one row for each active ingredient (ai). For example, if a product contains 2 ai's use 2 rows for that product. Once a row is completed for a given product, then only Col. B (if applicable), C, and E need to be completed for additional rows regarding
Col. D: Formulation	Enter the formulation or the % of active ingredient.
Col. E, F, G: Application Rate	As a cross check, EPA is requesting both the amount of active ingredient in Col. E and product applied per area in Col. F. Indicate the unit of the product in Col. G.
Col. H, I, J: Prices and Costs	**Use 2001 prices and costs.** If the product is custom applied you may enter the total cost in the last column (Col. M) and override the formula. If a pesticide is applied by the user, enter the price of the product in Col. H and the cost of applying it in Col. I. Enter any other costs associated with **applying** this product in Col. J, specifying what they are in the comments section at the bottom of this sheet.
Col. K: Area Treated	Enter the area receiving at least one application of the pesticide.
Col. L: # of Applications per Year	Enter the number of applications in a fumigation cycle comparable to methyl bromide for this alternative pest control regimen. Since this number is an average, it does not need to be a whole number.
Col. M: Cost per Area in 2001 Dollars	Enter the cost per area in 2001 dollars. Col. M will be calculated automatically using the data you have entered for a chemical pest control, or, the formula in Col. M can be overridden if the cost per area is known because the product was custom applied
Non-chemical Control	Enter data near the bottom of the form. Identify the control in Col. A. Enter the target pests in Col. B. Describe the non-chemical pest control Col. B-L. Enter the costs in Col. M in 2001 dollars.

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D	E	F	G	H	I	J	K	L	M
Name of Product	**Target Pests**	**Active Ingredients (ai) in Product**	**Formulation of Product**	**Application Rate**			**Price per Unit of the Product**	**Cost of Applying Pesticide per Area**	**Other Costs per Application per area**	**Area Treated at Least Once**	**# of Applications per Year**	**Cost per Area (2001$)**
				lbs. ai per Area per Application	**Units of product per Area per Application**	**Product Unit (e.g., lbs., gals)**						
Tarped Metham-sodium	weeds/fungi	MITC	42%	210 lbs	60	gallons					1	$ 2,000.00

Non-Chemical Pest Control	**Target Pests**	**Description**	**Cost/area**

Total $ 2,000.00

Comments:

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Worksheet 3-C. Alternatives - Crop/Commodity Yield and Gross

Metham-sodium

If a consortium is submitting this application, the data for this table should reflect a *representative* user.	
The purpose of this worksheet is to identify the gross revenue for units (crop, commodity, structure) when using an alternative compared to gross revenue when	
Col. A: Crop/Commodity	Enter all crops/commodities that can be grown/treated during the same interval of time comprising a methyl bromide fumigation cycle. If someone other than the applicant benefits from the application of methyl bromide in the fumigation cycle and you do not have the
Col. B: Price Factors	Enter in Col. B any factors that determine prices (e.g., grade, time, market). If you received different prices for your crop/commodity
Col. C: Unit of Crop/Commodity	Enter the unit of measurement for your crop/commodity.
Col. D: Crop/Commodity Yield	Enter the number of units of crop/commodity produced per area for that price factor identified.
Col. E: Price	Enter the average 2001 prices received by the users for that crop/commodity and price factor.
Col. F: Gross Revenue	In the electronic version, revenue is automatically calculated below using the data you entered for yield and price. If revenue is not equal to yield times price, you may override the formula and enter a different revenue amount. Please explain why this revenue
Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.	

A	B	C	D	E	F
Crop/Commodity	**Price Factors** (grade, time, market)	**Unit of Crop/Commodity** (e.g., pounds, bushels)	**Crop/Commodity Yield** (Units per area) thousand/acre	**Price** (per unit of crop/commodity) per thousand	**Revenue** (per area) acre
Pine seedlings	seedling quality, genetic g	1000 trees	621	40	$24,848
	fluctuations				$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
				Total Revenue	$ 24,848.00

Gross Revenue of Alternatives

Comments:

Note: revenue is only generated during the first two years following fumigation when the land is growing bareroot seedlings.

The reduction in the number of seedlings per bed is comparable for both Basamid and Metham-sodium; therefore, the revenue numbers expressed here are the same as for Basamid.

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Worksheet 3-D. Alternatives - Changes in Other Costs for Alternative: Metham-sodium

If a consortium is submitting this application, the data for this table should reflect a *representative user*.	
Enter data only for costs (other than the cost of alternative pest control) that change as a result of using the alternatives instead of methyl bromide. Enter the whole cost,	
Col. A: Operation or Cost Item	Identify the operations or cost items that change as a result of not using methyl bromide.
Col. B: Custom Operation Cost	Enter custom operation costs that change in Col. B.
Col. C, D, E: Costs per Area	Enter in Col. C and D, material and labor costs per area that change for operations done by user. The total cost per area is calculated automatically from the values you enter in Cols. C and D.
Col. F: Typical Equipment Used	Identify changes in the typical equipment used by the user as a result of not using methyl bromide. Please be specific such as tractor horsepower. No cost data are required in this column.
Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.	

A	B	C	D	E	F
Operation or Cost Item	**Custom Operation Cost per Area**	**Operation Done by User**			**Typical Equipment Used**
		Material Cost per Area	**Labor Cost per Area (acre)**	**Total Cost per Area (acre)**	
Hand Weeding		0	$60/acre/application	$ 360.00	Hand labor
Increased Herbicide Use					
seedling crop		$98.50	$120.00	$ 218.50	Tractor/Spray Rig
cover crop/fallow		$24.50	$59.40	$ 83.90	Tractor/Spray Rig
Total Custom per Area			**User Total per area**	$ 662.40	

Comments:

Assumes increase in weed populations (ex. Nutsedge) will require one hand weedings per acre per month from May through October. Cost per acre is estimated to be $60 which represents a hand weeding crew of 5 plus one supervisor.

Additional herbicide use will be needed when growing seedlings the first two years of the fumigation cycle and also during the second two years when the soil is fallow or in cover crop.

Additional indirect costs per acre at listed in 3-A

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

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Research Summary Table

Alternative: Metham-sodium **Study:** See "comments" below

Provide one summary table for each study being described.	
Provide a summary table of research information that will allow us compare the impact of methyl bromide and the alternative regimen on such things as pest control, yield or quality of the	
Col. A: Treatment Number	List the treatment number from the research study you are citing.
Col. B: Treatment	List what type of pest control method was used.
Col. C: Rate	Enter the pounds or gallons of a chemical used, days of solarization, etc.
Col. D, F, H, J, L, N: Interval	Enter the interval after treatment that the rating was taken. Enter the interval (days, weeks or months) in the column heading or in the comments section. In the comments describe the rating scale (e.g. 0 to 100 where 100 is complete control).
Cols. E, G, I, K, M, O: Rating for Interval:	Use these columns to describe the level of control provided for a specific pest and the time interval at which the rating was taken. For example, a study for nematode control may have looked at nematode population in the soil pre-treatment, 3 weeks after treatment, and 6 weeks after treatment. In this example, type
Control of Pests 1 and 2 (Cols. D - I and Cols. J - O):	For the target pest(s) in the study list the pest or pest species being rated in the column header or the comments section. For example, a study for nematode control in tomatoes may have looked at sting nematode and stunt nematode. Enter sting nematode for pest 1 in the Col F header below and stunt nematode for pest 2 in the Col. L header below. In the comments section describe the rating system used (0 to 100 scale where 0 is no control, number of nematodes per gram of soil, number of colony forming units per gram of soil, etc.).
Col. J: Yield	Enter the marketable yield of the crop or commodity and specify the units (lbs./acre, tons) in the column header or comments section.
Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.	

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Treatment Number	**Treatment**	**Rate (lbs. or gals. ai per area)**	**Pest 1**						**Pest 2**						**Yield (units/area)**
			Interval 1	**Rating for Interval 1**	**Interval 2**	**Rating for Interval 2**	**Interval 3**	**Rating for Interval 3**	**Interval 1**	**Rating for Interval 1**	**Interval 2**	**Rating for Interval 2**	**Interval 3**	**Rating for Interval 3**	
See Comment															

Comments:
See appendix 3 for list of research publications.

OMB Control # 2060-0482

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Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

In this worksheet, you should address why an alternative pest management strategy on the list (see previous
For worksheet 3-A you must complete one worksheet for each alternative, for each research study addressed.
When completing Section II, if you cite a study that is on the EPA website, you only need to complete questions
Summarize each of the research studies you cite in the Research Summary Worksheet.
If you prefer, you may provide the information requested in this worksheet in a narrative review of one or more

BACKGROUND

EPA must consider whether alternative pest control measures (pesticide and non-pesticidal, and their combination) could
There are three major ways you can provide the Agency with proof of your investigative work.
Whether you conduct the research yourself or cite studies developed by others, it is important that the studies be
The Agency has posted many research studies on a variety of crops on its website and knows of more studies currently
In addition, EPA acknowledges that, for certain circumstances, some alternatives are not technically feasible and

Use additional pages as needed.

Alternative: **Organic Amendments** **Study:** **Various see Appendix 3**

Section I. Initial Screening on Technical Feasibility of Alternatives

1. Are there any location-specific restrictions that inhibit the use of this alternative on your site?

1a. Full use permitted Yes
1b. Township caps
1c. Alternative not acceptable in consuming country
1d. Other (Please describe)

If use of this alternative is precluded by regulatory restriction for all users covered by this

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Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

Section II. Existing Research Studies on Alternatives to Methyl Bromide

1. Is the study on EPA's website? **Yes** _____ **No** X

1a. If not on the EPA website, please attach a copy.

See Appendix 3 for list. All articles are part of the public domain and can be used freely.

2. Author(s) or researcher(s) See Appendix 3 for list.

3. Publication and Date of Publicatior See Appendix 3

4. Location of research stud Various forest tree seedling nurseries in the United States

5. Name of alternative(s) in study. If more than one alternative, list the ones you wish to discuss.

Various with several different organic amendments

6. Was crop yield measured in the stu **Yes** x **No** _____

(seedling size, bed density)

7. Describe the effectiveness of the alternative in controlling pests in the study.

Organic amendments have been tested as an alternative to methyl bromide fumigation. Known advantages of organic amendments include increased soil organic matter levels resulting in improved soil structure and cation exchange capacity (Davey and Krause, 1980). In fact, International Paper SuperTree nurseries include the addition of organic amendments (ex. sawdust, cotton gin waste, etc.) as a routine measure to maintain the productivity of nursery soils. The effect of organic amendments

on the population of soil pathogens and parasites, and the effect on seedling quality have been evaluated in several recent studies.

Seedling health has not been affected after several consecutive crops in soil treated with organic amendments at forest tree nurseries in the southeast (Kannwischer-Mitchell, et al, 1995, 1997; Barnard, et al., 1996) and the pacific northwest (James, et al, 1997; Stone, et al, 1997). In fact, there was no significant difference in disease incidence between soil treated with various fumigants (e.g. Basamid, methyl bromide) and soil organic amendments even after four consecutive seedling crops. However, seedling survival and seedling size were typically greater on fumigated soil than on soil treated with organic amendments. Nursery bed densities at the end of the growing season indicated soil treated with methyl bromide generally had 1 to 3 more seedlings per sq.ft. than did soil treated with pine bark or compost (Kannwischer-Mitchell, et al, 1995; Barnard, et al, 1996). In the pacific northwest, the two-year old seed bed densities of douglas fir (*Pseudotsuga menziesii)* and ponderosa pine (*Pinus ponderosa*) were variable (+/-) depending on the organic amendment, cropping technique, and soil fumigant (Stone, loss in the number of seedlings per square foot will result in less revenue since fewer seedlings will be available for sale.

Seedlings were generally larger when grown in fumigated soil than in soil treated with organic amendments in both Florida and South Carolina after several consecutive seedling crops (Kannwischer-Mitchell, et al, 1995, 1997; Barnard, et al., 1996). However, some pine bark or compost treatments did have greater average root collar diameter than fumigated soil. Similarly, average root collar diameter in fumigated soil in the pacific northwest was equal, greater, or smaller than the root collar diameter seen in soil treated with organic amendments or crop rotations (Stone, et al, 1997). Evidently the effect of soil organic amendments on seedling size has been inconsistent. A small reduction in root collar diameter of only 2mm can seriously affect the revenue from seedling sales (see discussion in 3-A

Organic amendments may affect the populations of plant pathogenic fungi; however, weeds are not controlled. In fact, careful consideration must be given to the source of organic amendments in order to prevent the introduction of additional weeds into the nursery (Lantz, 1997). Nutsedge (*Cyperus spp.*) populations could prosper with the use of organic amendments. As explained in section 3-A Basamid and 3-A Metham-sodium, nutsedge control is very difficult without methyl bromide fumigation. Decreased seedling quality and increased nursery costs associated with more hand weeding and herbicide use are inevitable without methyl bromide fumigation.

8. **Discuss how the results of the study apply to your situation. Would you expect similar results?**
   At present, we expect similar results since both the Florida and South Carolina nurseries have soil types typical for all International Paper SuperTree nurseries. In fact, the South Carolina nursery is a member of International Paper's SuperTree nursery family. Additional research may show a role for organic amendments, most likely when used as part of an integrated pest management program.

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Worksheet 3-B. Alternatives - Pest Control Regimen Costs for A — Organic Amendments

If a consortium is submitting this application, the data for this table should reflect a **representative user.**	
Col. A: Name of Product and Non-chemical Control	Enter all alternatives and non-chemical pest control that would replace one treatment of methyl bromide throughout the fumigation If someone other than the applicant previously benefited from the application of methyl bromide in the fumigation cycle and you do not
Col. B: Target Pests	Be as specific as possible regarding the species or classes of pests controlled by the active ingredient or pesticide product.
Col. C: Active Ingredients	Use one row for each active ingredient (ai). For example, if a product contains 2 ai's use 2 rows for that product. Once a row is
Col. D: Formulation	Enter the formulation or the % of active ingredient.
Col. E, F, G: Application Rate	As a cross check, EPA is requesting both the amount of active ingredient in Col. E and product applied per area in Col. F. Indicate the
Col. H, I, J: Prices and Costs	**Use 2001 prices and costs.** If the product is custom applied you may enter the total cost in the last column (Col. M) and override the
Col. K: Area Treated	Enter the area receiving at least one application of the pesticide.
Col. L: # of Applications per Year	Enter the number of applications in a fumigation cycle comparable to methyl bromide for this alternative pest control regimen. Since this number is an average, it does not need to be a whole number.
Col. M: Cost per Area in 2001 Dollars	Enter the cost per area in 2001 dollars. Col. M will be calculated automatically using the data you have entered for a chemical pest control, or, the formula in Col. M can be overridden if the cost per area is known because the product was custom applied.
Non-chemical Control	Enter data near the bottom of the form. Identify the control in Col. A. Enter the target pests in Col. B. Describe the non-chemical pest
Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.	

A	B	C	D	E	F	G	H	I	J	K	L	M
Name of Product	**Target Pests**	**Active Ingredients (ai) in Product**	**Formulation of Product**	**Application Rate**			**Price per Unit of the Product**	**Cost of Applying Pesticide per Area**	**Other Costs per Application**	**Area Treated at Least Once**	**# of Applications per Year**	**Cost per Area (2001$)**
				lbs. ai per Area per Application	**Units of product per Area per Application**	**Product Unit (e.g., lbs., gals)**						
Organic	Soil Fungi	none	100%	540	cu. Yrds	lbs	$ 7.50					$ 4,050.00
Matter												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
Non-Chemical Pest Control	**arget Pest**	**Description**										**Cost/area**
											Total	$ 4,050.00

Comments:
Organic amendments when used as an alternative to methyl bromide fumigation should be applied from 1 to 4 inches thick (Carey and McNabb, 1996).

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Worksheet 3-C. Alternatives - Crop/Commodity Yield and Gross Reven

Organic Amendments

If a consortium is submitting this application, the data for this table should reflect a *representative* user.	
The purpose of this worksheet is to identify the gross revenue for units (crop, commodity, structure) when using an alternative compared to gross revenue when using	
Col. A: Crop/Commodity	Enter all crops/commodities that can be grown/treated during the same interval of time comprising a methyl bromide fumigation cycle. Please If someone other than the applicant benefits from the application of methyl bromide in the fumigation cycle and you do not have the
Col. B: Price Factors	Enter in Col. B any factors that determine prices (e.g., grade, time, market). If you received different prices for your crop/commodity as a
Col. C: Unit of Crop/Commodity	Enter the unit of measurement for your crop/commodity.
Col. D: Crop/Commodity Yield	Enter the number of units of crop/commodity produced per area for that price factor identified.
Col. E: Price	Enter the average 2001 prices received by the users for that crop/commodity and price factor.
Col. F: Gross Revenue	In the electronic version, revenue is automatically calculated below using the data you entered for yield and price. If revenue is not equal to
Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.	

A	B	C	D	E	F
Crop/Commodity	**Price Factors** (grade, time, market)	**Unit of Crop/Commodity** (e.g., pounds, bushels)	**Crop/Commodity Yield** (Units per area) thousand/acre	**Price** (per unit of crop/commodity) per thousand	**Revenue** (per area) acre
Pine seedlings	seedling quality, genetic gain	1000 trees	621	40	$24,848
	fluctuations				
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
				Total Revenue	$ 24,848.00

Gross Revenue of Alternatives

Comments: Note: revenue is only generated during the first two years following fumigation when the land is growing bareroot seedlings.

Assumes loss of 2.2 seedlings per sq. ft. of nursery bed.

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Worksheet 3-D. Alternatives - Changes in Other Costs for Alternative Organic Amendments

If a consortium is submitting this application, the data for this table should reflect a *representative user*.	
Enter data only for costs (other than the cost of alternative pest control) that change as a result of using the alternatives instead of methyl bromide. Enter the whole	
Col. A: Operation or Cost Item	Identify the operations or cost items that change as a result of not using methyl bromide.
Col. B: Custom Operation Cost	Enter custom operation costs that change in Col. B.
Col. C, D, E: Costs per Area	Enter in Col. C and D, material and labor costs per area that change for operations done by user. The total cost per area is calculated automatically from the values you enter in Cols. C and D.
Col. F: Typical Equipment Used	Identify changes in the typical equipment used by the user as a result of not using methyl bromide. Please be specific such as tractor horsepower. No cost data are required in this column.
Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.	

A	B	C	D	E	F
Operation or Cost Item	**Custom Operation Cost per Area**	**Operation Done by User**			**Typical Equipment Used**
		Material Cost per Area	**Labor Cost per Area (acre)**	**Total Cost per Area (acre)**	
Hand Weeding		0	$60/acre/application	$ 360.00	Hand labor
Increased Herbicide Use					
seedling crop		$98.50	$120.00	$ 218.50	Tractor/Spray Rig
cover crop/fallow		$24.50	$59.40	$ 83.90	Tractor/Spray Rig
Total Custom per Area			**User Total per area**	$ 662.40	

Comments:

Assumes increase in weed populations (ex. Nutsedge) will require one hand weedings per acre per month from May through October. Cost per acre is estimated to be $60 which represents a hand weeding crew of 5 plus one supervisor.

Weed control is not available with organic amendments. More herbicides will be needed during the growing season and in the fallow period.

Additional indirect costs per acre at listed in 3-A

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Research Summary

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Alternative: Organic Amendments **Study:** See "comments" below

Provide one summary table for each study being described.

Provide a summary table of research information that will allow us compare the impact of methyl bromide and the alternative regimen on such things as pest control, yield or quali

Col. A: Treatment Number	List the treatment number from the research study you are citing.
Col. B: Treatment	List what type of pest control method was used.
Col. C: Rate	Enter the pounds or gallons of a chemical used, days of solarization, etc.
Col. D, F, H, J, L, N: Interval	Enter the interval after treatment that the rating was taken. Enter the interval (days, weeks or months) in the column heading or in the comments section. In the comments describe the rating scale (e.g. 0 to 100 where 100 is complete control).
Cols. E, G, I, K, M, O: Rating for Interval:	Use these columns to describe the level of control provided for a specific pest and the time interval at which the rating was taken. For example, a study for nematode control may have looked at nematode population in the soil pre-treatment, 3 weeks after treatment, and 6 weeks after treatment. In this example, type over the words "Rating Interval 1" with "pre-treatment", type over "Rating Interval 2" with "3 weeks", and type over "Rating Interval 3" with "6 weeks." If you are completing the printed version, please define Rating Interval in the comments below.
Control of Pests 1 and 2 (Cols. D - I and Cols. J - O):	For the target pest(s) in the study list the pest or pest species being rated in the column header or the comments section. For example, a study for nematode control in tomatoes may have looked at sting nematode and stunt nematode. Enter sting nematode for pest 1 in the Col F header below and stunt nematode for pest 2 in the Col. L header below. In the comments section describe the rating system used (0 to 100 scale where 0 is no control, number of nematodes per gram of soil, number of colony forming units per gram of soil, etc.).
Col. J: Yield	Enter the marketable yield of the crop or commodity and specify the units (lbs./acre, tons) in the column header or comments section.

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Treatment Number	**Treatment**	**Rate (lbs. or gals. ai per area)**	**Pest 1**						**Pest 2**						**Yield (units/area)**
			Interval 1	**Rating for Interval 1**	**Interval 2**	**Rating for Interval 2**	**Interval 3**	**Rating for Interval 3**	**Interval 1**	**Rating for Interval 1**	**Interval 2**	**Rating for Interval 2**	**Interval 3**	**Rating for Interval 3**	
ee Comment															

Comments:

See appendix 3 for list of research publications.

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Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

In this worksheet, you should address why an alternative pest management strategy on the list (see previous
For worksheet 3-A you must complete one worksheet for each alternative, for each research study addressed.
When completing Section II, if you cite a study that is on the EPA website, you only need to complete questions
Summarize each of the research studies you cite in the Research Summary Worksheet.
If you prefer, you may provide the information requested in this worksheet in a narrative review of one or more

BACKGROUND

EPA must consider whether alternative pest control measures (pesticide and non-pesticidal, and their combination) could
There are three major ways you can provide the Agency with proof of your investigative work.
Whether you conduct the research yourself or cite studies developed by others, it is important that the studies be
The Agency has posted many research studies on a variety of crops on its website and knows of more studies currently
In addition, EPA acknowledges that, for certain circumstances, some alternatives are not technically feasible and

Use additional pages as needed.

Alternative: **Flooding/Solarization** **Study:** **Various see Appendix 3**

Section I. Initial Screening on Technical Feasibility of Alternatives

1. Are there any location-specific restrictions that inhibit the use of this alternative on your site?

1a. Full use permitted Yes
1b. Township caps
1c. Alternative not acceptable in consuming country
1d. Other (Please describe)

If use of this alternative is precluded by regulatory restriction for all users covered by this

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Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

Section II. Existing Research Studies on Alternatives to Methyl Bromide

1. Is the study on EPA's website? **Yes** _____ **No** X

1a. If not on the EPA website, please attach a copy.

See Appendix 3 for list. All articles are part of the public domain and can be used freely.

2. Author(s) or researcher(s) See Appendix 3 for list

3. Publication and Date of Publicatior See Appendix 3

4. Location of research stud Various forest tree seedling nurseries in the United States

5. Name of alternative(s) in study. If more than one alternative, list the ones you wish to discuss.

Flooding
Solarization

6. Was crop yield measured in the stu **Yes** _____ **No** X

7. Describe the effectiveness of the alternative in controlling pests in the study.

Flooding is not feasible at International Paper SuperTree nurseries. Our nursery soils are well drained and would require an excessive volume of water to keep the fields flooded. The fields are also designed to promote water drainage. A slope at least one percent is built into all fields to prevent water from standing. Flooding can only be used in flat, low-lying areas with high seasonal water tables (EPA, 2002).

Solarization is a method in which clear plastic is placed on top of the soil in order to trap solar radiation which raises soil temperature (Carey and McNabb, 1996; EPA, 2002). Soil temperatures above 98F are required to kill or disable soil pathogens and parasites. With increasing soil temperature, the time needed to kill soil pathogens and parasites decreases. At 98F, up to 4 weeks exposure is needed to adversely affect soil pathogens and parasites. In contrast, only 1 to 6 hrs are needed if soil temperature is 117F (Katan and DeVay, 1991). As expected soil temperature decreases with soil depth. A solarization study in Florida found soil temperatures of 121, 116, and 107F at soil depths of 2, 6, and 10 inches, respectively (Chellemi, et al, 1994). Weyerhaeuser (EPA, 2002) has found similar soil temperatures of 122-140F at a depth of 3 inches in Arkansas. The efficiency of solarization is dependent on air temperature, day length, and other factors. The time for optimum solarization is during the summer months.

Normally, nursery fields are fumigated in the late fall or early spring. Both periods are not suitable for solarization. A summer solarization would require clear plastic mulch to be laid on the soil for many months to achieve adequate soil temperatures deep in the soil profile and prevent erosion and re-contamination from soil outside the treated area (Carey and McNabb, 1996). Although forest tree nursery soils are usually uniform, most fields contain areas that have soil textural and drainage differences. These areas would not be treated to the same degree with soil solarization as the majority of the field. The quality of the seedlings produced in these areas would be different than the rest of the field. Unfortunately, many weed seeds are resistant to high temperatures and would not be affected. Nutsedge (Cyperus spp) is not affected by the soil temperatures produced by solarization.

Although not currently feasible, solarization may play an important role in an integrated pest management system. Additional research is needed to combine several alternatives (including organic matter, solarization, etc.) into one crop rotation package.

Discuss how the results of the study apply to your situation. Would you expect similar results?
Flooding is not feasible due to soil drainage and slope.
We would expect similar solarization results if we could successfully employ solarization during the summer months and economically control weeds. More research is needed to confirm affect of solarization on soil pathogens and parasites deep (about 10"-12") in nursery soils.

8.

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Worksheet 3-B. Alternatives - Pest Control Regimen Costs f — Flooding; Solarization

If a consortium is submitting this application, the data for this table should reflect a **representative user.**	
Col. A: Name of Product and	Enter all alternatives and non-chemical pest control that would replace one treatment of methyl bromide throughout the fumigation cycle. See If someone other than the applicant previously benefited from the application of methyl bromide in the fumigation cycle and you do not have
Col. B: Target Pests	Be as specific as possible regarding the species or classes of pests controlled by the active ingredient or pesticide product.
Col. C: Active Ingredients	Use one row for each active ingredient (ai). For example, if a product contains 2 ai's use 2 rows for that product. Once a row is completed for a given product, then only Col. B (if applicable), C, and E need to be completed for additional rows regarding the same product.
Col. D: Formulation	Enter the formulation or the % of active ingredient.
Col. E, F, G: Application Rate	As a cross check, EPA is requesting both the amount of active ingredient in Col. E and product applied per area in Col. F. Indicate the unit of the product in Col. G.
Col. H, I, J: Prices and Costs	**Use 2001 prices and costs.** If the product is custom applied you may enter the total cost in the last column (Col. M) and override the formula. If a pesticide is applied by the user, enter the price of the product in Col. H and the cost of applying it in Col. I. Enter any other
Col. K: Area Treated	Enter the area receiving at least one application of the pesticide.
Col. L: # of Applications per Year	Enter the number of applications in a fumigation cycle comparable to methyl bromide for this alternative pest control regimen. Since this number is an average, it does not need to be a whole number.
Col. M: Cost per Area in 2001 Dollars	Enter the cost per area in 2001 dollars. Col. M will be calculated automatically using the data you have entered for a chemical pest control, or, the formula in Col. M can be overridden if the cost per area is known because the product was custom applied.
Non-chemical Control	Enter data near the bottom of the form. Identify the control in Col. A. Enter the target pests in Col. B. Describe the non-chemical pest

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D	E	F	G	H	I	J	K	L	M
Name of Product	**Target Pests**	**Active Ingredients (ai) in Product**	**Formulation of Product**	**Application Rate**			**Price per Unit of the Product**	**Cost of Applying Pesticide per Area**	**Other Costs per Application**	**Area Treated at Least Once**	**# of Applications per Year**	**Cost per Area (2001$)**
				lbs. ai per Area per Application	**Units of product per Area per Application**	**Product Unit (e.g., lbs., gals)**						
Solarization	Soil Fungi	none	none	none	tarp/acre	sq.ft.	$ 500.00					$ 500.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
Non-Chemical Pest Control	**Target Pest**	**Description**										**Cost/area**
											Total	$ 500.00

Comments:
Flooding not possible.
Estimated labor, tarp installation and removal costs

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Worksheet 3-C. Alternatives - Crop/Commodity Yield and Gross Reven — Flooding; Solarization

If a consortium is submitting this application, the data for this table should reflect a *representative* user.	
The purpose of this worksheet is to identify the gross revenue for units (crop, commodity, structure) when using an alternative compared to gross revenue when using	
Col. A: Crop/Commodity	Enter all crops/commodities that can be grown/treated during the same interval of time comprising a methyl bromide fumigation cycle. If someone other than the applicant benefits from the application of methyl bromide in the fumigation cycle and you do not have the
Col. B: Price Factors	Enter in Col. B any factors that determine prices (e.g., grade, time, market). If you received different prices for your crop/commodity as a
Col. C: Unit of Crop/Commodity	Enter the unit of measurement for your crop/commodity.
Col. D: Crop/Commodity Yield	Enter the number of units of crop/commodity produced per area for that price factor identified.
Col. E: Price	Enter the average 2001 prices received by the users for that crop/commodity and price factor.
Col. F: Gross Revenue	In the electronic version, revenue is automatically calculated below using the data you entered for yield and price. If revenue is not equal to
Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.	

A	B	C	D	E	F
Crop/Commodity	**Price Factors** (grade, time, market)	**Unit of Crop/Commodity** (e.g., pounds, bushels)	**Crop/Commodity Yield** (Units per area) thousand/acre	**Price** (per unit of crop/commodity) per	**Revenue** (per area) acre
Pine seedlings	seedling quality, genetic gai	1000 trees	621	40	$24,848
	fluctuations				
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
				Total Revenue	$ 24,848.00

Gross Revenue of Alternatives

Comments: Note: revenue is only generated during the first two years following fumigation when the land is growing bareroot seedlings.

The number of seedlings per acre will decrease due to greater weed competition.

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Worksheet 3-D. Alternatives - Changes in Other Costs for Alternative: Flooding; Solarization

If a consortium is submitting this application, the data for this table should reflect a *representative user*.	
Enter data only for costs (other than the cost of alternative pest control) that change as a result of using the alternatives instead of methyl bromide. Enter the whole cost,	
Col. A: Operation or Cost Item	Identify the operations or cost items that change as a result of not using methyl bromide.
Col. B: Custom Operation Cost	Enter custom operation costs that change in Col. B.
Col. C, D, E: Costs per Area	Enter in Col. C and D, material and labor costs per area that change for operations done by user. The total cost per area is calculated automatically from the values you enter in Cols. C and D.
Col. F: Typical Equipment Used	Identify changes in the typical equipment used by the user as a result of not using methyl bromide. Please be specific such as tractor horsepower. No cost data are required in this column.
Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.	

A	B	C	D	E	F
Operation or Cost Item	**Custom Operation Cost per Area**	**Operation Done by User**			**Typical Equipment Used**
		Material Cost per Area	**Labor Cost per Area (acre)**	**Total Cost per Area (acre)**	
Hand Weeding		0	$60/acre/application	$ 360.00	Hand labor
Increased Herbicide Use					
seedling crop		$98.50	$120.00	$ 218.50	Tractor/Spray Rig
cover crop/fallow		$24.50	$59.40	$ 83.90	Tractor/Spray Rig
Apply soil organic matter		$4,050	$40	$4,090	Tractor/spreader
(e.g. sawdust)					
Total Custom per Area			**User Total per area**	$ 4,752.40	

Comments:

Assumes increase in weed populations (ex. Nutsedge) will require one hand weedings per acre per month from May through October. Cost per acre is estimated to be $60 which represents a hand weeding crew of 5 plus one supervisor.

Weed control is limited with solarization. More herbicides and hand weeding required.
Since cover crop is not grown the summer before sowing a large volume of organic matter is needed.

Flooding not possible.

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Research Summary

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Alternative: Flooding; Solarization **Study:** See "comments" below

Provide one summary table for each study being described.

Provide a summary table of research information that will allow us compare the impact of methyl bromide and the alternative regimen on such things as pest control, yield or quali

Col. A: Treatment Number	List the treatment number from the research study you are citing.
Col. B: Treatment	List what type of pest control method was used.
Col. C: Rate	Enter the pounds or gallons of a chemical used, days of solarization, etc.
Col. D, F, H, J, L, N: Interval	Enter the interval after treatment that the rating was taken. Enter the interval (days, weeks or months) in the column heading or in the comments section. In the comments describe the rating scale (e.g. 0 to 100 where 100 is complete control).
Cols. E, G, I, K, M, O: Rating for Interval:	Use these columns to describe the level of control provided for a specific pest and the time interval at which the rating was taken. For example, a study for nematode control may have looked at nematode population in the soil pre-treatment, 3 weeks after treatment, and 6 weeks after treatment. In this example, type over the words "Rating Interval 1" with "pre-treatment", type over "Rating Interval 2" with "3 weeks", and type over "Rating Interval 3" with "6 weeks." If you are completing the printed version, please define Rating Interval in the comments below.
Control of Pests 1 and 2 (Cols. D - I and Cols. J - O):	For the target pest(s) in the study list the pest or pest species being rated in the column header or the comments section. For example, a study for nematode control in tomatoes may have looked at sting nematode and stunt nematode. Enter sting nematode for pest 1 in the Col F header below and stunt nematode for pest 2 in the Col. L header below. In the comments section describe the rating system used (0 to 100 scale where 0 is no control, number of nematodes per gram of soil, number of colony forming units per gram of soil, etc.).
Col. J: Yield	Enter the marketable yield of the crop or commodity and specify the units (lbs./acre, tons) in the column header or comments section.

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Treatment Number	**Treatment**	**Rate (lbs. or gals. ai per area)**	**Pest 1**						**Pest 2**						**Yield (units/area)**
			Interval 1	**Rating for Interval 1**	**Interval 2**	**Rating for Interval 2**	**Interval 3**	**Rating for Interval 3**	**Interval 1**	**Rating for Interval 1**	**Interval 2**	**Rating for Interval 2**	**Interval 3**	**Rating for Interval 3**	
ee Comment															

Comments:

See appendix 3 for list of research publications.

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Worksheet 4. Alternatives - Future Research Plans

Please describe future plans to test alternatives to methyl bromide. (All available methyl bromide alternatives from the alternatives list should have been tested or have future tests planned.) There is no need to complete a separate worksheet for future research plans for each alternative - you may use this worksheet to describe <u>all</u> future research plans.

1. **Name of study:** Several studies that will evaluate potential chemical and integrated pest management alternatives to methyl bromide fumigation.

2. **Researcher(s):** International Paper is a strong contributing member of the Auburn University Nursery Cooperative. As a consequence, we eagerly support Cooperative research activities by installing at our nurseries appropriate methyl bromide alternative research studies. In addition, we will be installing in-house research for further evaluation of methyl bromide alternatives.

3. **Your test is planned for:** 2002 and as needed

4. **Location:** Nine International Paper nurseries are available for research studies.

5. **Name of alternative to be tested:**

Various potential fumigants such as: methyl iodide, chloropicrin, eptc, azides.

Also, integrated pest management techniques including crop rotations, fallow field soil management, selected use of herbicides, solarization, and allopathic interactions of crops and weeds such as the reduction in number and size of nutsedge tubers associated with allopathic substances produced by sweet potatoes (*Ipomea spp*).

International Paper will be exploring all suitable alternatives similar to that done by Weyerhaeuser (EPA, 2002)

6. **Will crop yield be measured in the study?** Yes X No _____

Includes seedling quality, size, survival

7. **If additional testing is not planned, please explain why. (For example, the available alternatives have been tested and found unsuitable, an alternative has been identified but is not yet registered for this crop, available alternatives are too expensive for this crop, etc.)**

International Paper is very concerned about health, safety, and environmental quality. We will implement any methyl bromide alternative that is safe to use and promotes production of high quality SuperTree seedlings in a cost effective manner.

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Worksheet 5. Additional Information

1. How will you minimize your use and/or emissions of methyl bromide?

1a. Check all methods you will use
- ____ Nothing
- X Tarpaulin (high density polyethylene)
- ____ Virtually impermeable film (VIF)
- ____ Cultural practices (please specify) _____

1b. Will you use other pesticides to reduce use of methyl bromide? Yes X No ____

If yes please specify. Increased use of herbicides in cover crops and during seedling crop production

1c. Other non-chemical methods: (please specify):
Allopathic effects of cover crops on weed seeds is a promising area.

2. Do you have access to recycled methyl bromide? Yes ____ No X

If yes, how many pounds? _____ lbs.

3. Do you anticipate that you will have any methyl bromide in storage on January 1, 2005? Yes ____ No X

If yes, how many pounds? _____ lbs.

4. What is the cumulative amount spent to date by the user or consortium on research to develop alternatives to methyl bromide (beginning in 1992)? $ 1,005,000.00

The figure above includes International Paper's annual dues which helps support all Auburn University Nursery Cooperative research. Also, the revenue loss from seedlings damaged by Metham-sodium operational scale research trial at Texas is included. In-house research costs not borne by the Cooperative are also included.

5. Other investments, if any, made to reduce your reliance on methyl bromide. Describe each investment and its associated cost.

Annual dues for International Paper's membership in the Auburn University Nursery Cooperative are $8,300 per year. This money helps to support herbicide and nursery cultural research that may help reduce the need for methyl bromide.

6. Identify what factors would allow you to stop or reduce your use of methyl bromide (e.g. registration of particular pesticide; completion of research plan; capital outlay).

An effective methyl bromide fumigation alternative must be able to produce seedlings of sufficient quality, size, and numbers so that total revenues are not affected. The cost associated with the alternative must not reduce our ability to earn an acceptable ROI. Further, any alternative must meet International Paper's requirements for health, safety, and environmental stewardship.

When do you expect these to occur? As soon as possible but in reality we do not know.

7. Range of acres farmed by growers included in this application?
(insert number of users in each category)

_____ 0-10 acres
_____ 10-25 acres

_____ 25-50 acres
_____ 50-100 acres
X 100-200 acres note: acres suitable for growing pine and seedlings
_____ 200-400 acres nine International Paper SuperTree nurseries
_____ over 400 acres

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Worksheet 5. Additional Information (continued)

8. Range of square feet of the area to which applicants included in this application will apply methyl bromide? (insert number of users in each category)

____ 0 - 5,000 sq. ft.
____ 5,001 - 10,000 sq. ft.
____ 10,001 - 20,000 sq. ft.
____ 20,001 - 40,000 sq. ft.
____ 40,001 - 80,000 sq. ft.
____ 80,001 - 160,000 sq. ft.
__X__ over 160,000 sq. ft. At each of nine International Paper SuperTree nurseries

The following is a description of the research effort conducted by the Auburn University Nursery Cooperative and was obtained from the Auburn University Nursery Management Cooperative methyl bromide CUE application.

The Coop. estimates that efforts to find alternatives to MBr have occupied a third of our research effort since 1993. With an annual operating budget of $200,000 this would be $666,000. This includes about 50% of the time for one Research Fellow and 10% and 25% respectively of two Technicians that are full time employees of the Coop but does not include the time of Auburn faculty associated with the Coop. The Contribution of Auburn University through faculty salaries of those three members closely associated with the Nursery Coop. during this period should add approximately $150,000.

A substantial contribution to research but not funded by the Auburn Coop has been the efforts by Dr. Scott Enebak into potential biological methods (primarily PGPR research) to offset the loss of MBr. Since 1996, Dr. Enebak has generated $300,792 in grants for his PGPR research. To those grants, Auburn has contributed $108,000 for a full time technician and student workers who have been employed in this research for a total of $411,612 for PGPR and fumigation research.

The contribution of Hendrix and Dail to our research effort is calculated as $39, 061. This figure would not purchase the materials and labor on the open market. No commercial company would haul materials to Texas, 2,000 mile round trip, to treat half an acre for $3,000.

The research within the Coop is highly cooperative. Nothing can be done without the cooperation of the nursery that agrees to allow the study to be placed on its production beds. It is very difficult to estimate the dollar contributions of these cooperating nurseries. For several studies the host nursery has just set the study area aside and not included it in its inventory of sold seedlings from treatment plots. In several studies seedlings from treatment plots have not been salable. The fate of seedlings within a study area often depends on market demands. In all instances we have received labor help from the host nursery. It is certain that the dollar value for this contribution is not zero, but very difficult to estimate.

We estimate cost of MBr replacement research associated with the Auburn Nursery Coop figures to have been $1,266,673 between 1993 and 2002.B67

I certify that all information contained in this document is factual to the best of my knowledge.

Signature Richard O. Barham **Date** 6-Sep-02

Print Name **Title** Manager; Nurseries and Orchards

International Paper Corporation

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Worksheet 5. Additional Information

Information in this application may be aggregated with information from other applications and used by the United States government to justify claims in the national nomination package that a particular use of methyl bromide be considered "critical" and authorized for an exemption beyond the 2005 phase out. Use of aggregate data will be crucial to making compelling arguments in favor of critical use exemptions. **By signing below**, you agree not to assert any claim of confidentiality that would affect the disclosure by EPA of aggregate information based in part on information contained in this application.

Signature Richard O. Barham **Date** 9-Sep-02

Print Name **Title** Manager, Nurseries and Orchards

International Paper Corporation

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Worksheet 6. Application Summary

This worksheet will be posted on the web to notify the public of requests for critical use exemptions beyond the 2005 phase out for methyl bromide. Therefore, this worksheet cannot be claimed as CBI.

1. **Name of Applicant:** International Paper

2. **Location:** Savannah, Georgia; Headquarters of the Nursery and Orchard Group

3. **Crop:** Pine SuperTree Seedlings

4. **Pounds of Methyl Bromide Requested** **2005** 92,000

5. **Area Treated with Methyl Bromide** **2005** 270 acre **units**

6. **If methyl bromide is requested for additional years, reason for request:**

International Paper SuperTree nurseries grow pine bareroot seedlings on a 2:2 rotation. For a given acre, two years produce seedlings and two years produce cover crop.

Prior to producing seedlings the land is fumigated. Fumigation is needed every year for those acres just beginning a new rotation cycle.

2006 92,000 **lbs.** **Area Treated** 270 acres **units**

2007 92,000 **lbs.** **Area Treated** 270 acres **units**

Place an "X" in the column(s) labeled "Not Technically Feasible" and/or "Not Economically Feasible" where appropriate. Use the "Reasons" column to describe why the potential alternative is not feasible.

Potential Alternatives	Not Technically Feasible	Not Economically Feasible	Reasons
Basamid		X	Potential human and environmental risks, lack of consistently demonstrable effectiveness, loss in crop quantity and quality. The ability to return a ROI of sufficient magnitude to warrant seedling production is doubtful.
Metham-Sodium		X	Proven human and environmental risks, lack of consistently demonstrable effectiveness, loss in crop quantity and quality. The ability to return a ROI of sufficient magnitude to warrant seedling production is doubtful.
Flooding	X	X	Not feasible due to sandy well drained soils. Further, nursery fields are designed to promote water movement from the fields.
Physical Removal	X	X	No practical method to physically remove nutsedge tubers. Handweeding is possible but prohibitively expensive on a large scale.
Ploughing	X	X	Traffic over nursery soils increases soil compaction. Repeated ploughing creates a "plow layer" which inhibits root growth and decreases soil aeration.
Solarization	X		Our nursery cycle (see Appendix 1 Crop Profile for details) requires fumigation to occur just after cover crop removal. This occurs in the late fall to early spring. This period is characterized by low air/soil temperatures and increased clouds. However, this method may have potential when included in a comprehensive IPM/crop rotation
Organic Amendments	X		The population of soil pathogens and parasites can be affected by organic amendments. However, the population of weeds is not influenced and could even increased depending on the source of the organic amendment. Effects on seedling size have been variable. This alternative may be effective in a comprehensive IPM/crop rotation
General IPM / Crop Rotations	X		At present a workable program to control weeds and soil pathogens and parasites has not be devised. This is the most promising area of research.

General Production Information

- Forestry in the United States, with an annual harvest of $24 billion and an employment of 1.6 million directly, 3.8 million indirectly (Pait, 2001), is dependent on a continuous supply of high quality seedlings. Tree planting in the United States has been on a steady upward trend since the mid 1930's, when about 140,000 acres were planted to the current (1998) level of over 2,600,000 acres (Moulton and Hernandez, 1999).

- According to Moulton and Hernandez (1999), ninety percent of the 1,642,089,000 seedlings produced in 1998 were planted on private lands. Non-industrial private forests landowners planted more acres than any other group of owners, 48% of the U.S. total. Forest industry planted 42% of the total. More trees are planted on State forest than on any other category of State and local government lands. Tree planting on the National forest are declining; acres planted in 1998 falling to the lowest level since 1960. The Southern states planted more acreage in trees than any other region (2,065,779), accounting for 79% of the U.S. total. More seedlings were planted in Georgia than any other state.

- Over 1.6 billion forest tree seedlings are grown annually on about 2,000 nursery acres in the U.S. Forest tree nurseries are located nationwide with 78% in the South, 17% in the West and 5% in the North. Each acre of loblolly pine nursery in the Southern U.S. has been calculated to be worth about $23,000.00 (South, 1999). Total value of the 1,560 acres of southern forest tree nurseries, the majority of which are loblolly nurseries, would then be approximately $35.8 million.

- The seed required to plant the nursery acres are provided from intensively managed Seed Orchards and are valued from $65 to $85 per pound. Approximately 45 pounds of seed are planted per acre of nursery for a seed cost per acre of $3300.

- Forest tree nurseries in the U.S. use a very small percentage of the herbicides, fungicides, insecticides, and fumigants used in the U.S. With the benefits provided by pesticides, seedlings can be produced for less than 4 cents. Without pesticides, seedlings would likely cost more than 15 cents each.

- The most effective pesticide used in pest management strategies is the fumigation of the nursery beds with methyl bromide. The pending loss of this option will likely increases reliance on more

Appendix 2. Figures

Figure 1. Heavy yellow nutsedge infestation in non-fumigated soil.

Photograph of heavy yellow nutsedge infestation on pine seedling beds. Nutsedge is bright green. Pine seedlings are lighter green and can barely be seen.

Appendix 2. Figures

Figure 2. Metham-sodium Outgassing Damage

Metham-sodium outgassing damage at International Paper's SuperTree Seedling nursery at Bullard, Texas. Soil fumigated with Metham-sodium can be seen at the top of the photograph. During the night, metham-sodium outgassed from the soil and drifted downwind over the pine seedling beds. Trees killed from the Metham-sodium are brownish-red. Trees not in the Metham-sodium plume remain green and alive.

Appendix 3

List of References

Auburn University Southern Forest Nursery Management Cooperative. 2002. Application for Critical Use Exemption of Methyl Bromide. (Submitted to EPA, September 9, 2002)

Barnard, E.L., M.E. Kannwischer-Mitchell, D.J. Mitchell, and S.W. Fraedrich. 1997. Development and field performance of slash and loblolly pine seedlings produced in fumigated nursery seedbeds and seedbeds amended with organic residues. Pp. 32-37

Carey, W.A. 1994a. Chemical alternatives to methyl bromide. In: Landis, T.D. andR.K. Dumrose, Tech. Coord., National Proceedings: Forest and Conservation Nursery Association, pp4-11

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Carey, W.A. 1999. A comparison of chloropicrin, metham-sodium, and EPTC combinations as methyl bromide alternatives at three nurseries. Auburn University Nursery Cooperative Research Rpt. 99-2, 4p
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Carey, W.A. 2000a. Seedling production and weed control by a potential replacement for methyl bromide at the Flint River Nursery. Auburn University Nursery Cooperative Research Rpt. 00-3, 3p.

Carey, W.A. 2000b. Seedling production by alternative fumigants, application.techniques and EPTC at the Glenville Regeneration Center. Auburn University Nursery Cooperative Research Rpt. 00-6, 4p.

Appendix 4. Effect of methyl bromide fumigation on nursery and pine plantation revenue and growth for both International Paper and southeastern forestry.

Benefits of methyl bromide fumigation accrue to both pine nurseries and plantations throughout the southeast. In the nursery, the effects of a single methyl bromide fumigation last for two consecutive pine seedling crops. At International Paper, one acre of fumigated nursery soil will produce over 1.3 million pine seedlings in two years. Only 215lbs of fumigant (80/20 methyl bromide @ 350lbs/acre) are needed to produce 1 million SuperTree seedlings or 0.21lbs per 1000 seedlings. The potential revenue for each nursery acre can approach nearly $55M over two years.

All chemical fumigation alternatives evaluated to date have lower seedling survival in the nursery bed compared to methyl bromide. The reduction can range from 2 to 9 seedlings per square foot (South and Carey, 2000). A reduction by 2 to 9 seedlings per square foot in each nursery acre will result in lower annual revenues by $2.2M or $9.7M, respectively. Without methyl bromide fumigation, the potential annual revenue from all nine International Paper SuperTree nurseries could be reduced by $1.1MM to more than $5.0MM. Annual pine seedling production in the southeast is approximately 900MM (Moulton, et al., 1995). A similar 2 to 9 seedling reduction per square foot could result in an annual revenue loss of up to $10.8MM across all pine seedling nurseries in the southeast.

Methyl bromide alternatives do not control weeds to any great extent. Weed competition in the nursery beds will result in lower seedling quality, particularly smaller seedling size, since the weeds are competing for the same nutrients and water as pine seedlings. With methyl bromide fumigation, International Paper SuperTree nurseries produce grade one (**R**oot **C**ollar **D**iameter > 4.8mm) seedling crops that are sold at an average price of $40/1000 seedlings. Grade 1 seedlings grow faster in the field and have increased survival once planted than smaller seedlings (South, et al, 2001). Many customers demand these larger seedlings so that their reforestation or ecosystem regeneration efforts are successful. A loss of methyl bromide fumigation will produce more grade 2 (RCD >3.8 <4.7mm) seedlings and cull seedlings that are too small to be planted. Seedling crops with a high proportion of grade 2 and cull seedlings cannot be sold at the current average selling price. A reduction in the average selling price of just $5/1000 seedlings would result in an additional loss of nearly $5.3M per acre per year.

The effects of one methyl bromide fumigation at a seedling nursery can still be seen at the end of a 25-year pine plantation rotation. Pine plantations established with grade one seedlings have greater stocking (i.e. number of